Underwater Bark Debris Survey
Tolstoi Bay 1 Log Transfer Facility
Prince of Wales Island, Alaska
May 2, 1996

Submitted to: Sealaska Timber Corp.
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Subject: 1996 Tolstoi LTF underwater bark debris survey.

Abstract:

The requested underwater survey to determine the extent of bark debris accumulation at the Tolstoi Log Transfer Facility (LTF), Prince of Wales Island, Alaska, was performed on May 2, 1996. Purpose of the survey is to satisfy the LTF's N.P.D.E.S. permit requirement for a bark deposition monitoring program. Permit number for the facility is AK - 004784 - 8.

Protocol for operating a bark monitoring program are given in the LTF Siting, Construction, Operation and Monitoring/Reporting Guidelines, 1985.

Methods:

The survey technique described follows the method recommended by government agencies for conducting LTF surveys.

A permanent reference point location is selected, ideally in the center of the bundle entry structure/ramp and located measurably close to an essentially permanent structure/landmark so that the reference point can be relocated in the future for continuation of the monitoring program. Depth of the reference point is positioned as close to 0 feet Mean Low Low Water (MLLW) as possible using the NOAA Tide Tables for tide correction calculations. Using the outer horizontal face of the entry structure as a reference plane (centerline of a drive down ramp/low angle slide), magnetic compass headings for five transects in 30 degree intervals are selected with the permanent reference point as the origin for each of the five transects. The middle transect is perpendicular (parallel to and in line with the ramp/slide axis) to the face of the entry structure.

Each transect is sampled at five meter intervals starting from the origin at the permanent reference point. Sample points continue to be established along a transect until a water depth of 60 feet MLLW is reached or the measured bark debris depth becomes insignificant. At each sample point several data are recorded by the diver; water depth, debris depth (measured in centimeters), percent coverage of debris (estimated by randomly dropping the meter stick at the sample point and noting amount of contact with debris), debris composition and character, substrate type, general algal and animal types and condition, abiotic factors such as direction and strength of current (if present) and the presence of any notable manmade debris. Transects are labelled with their magnetic compass heading for identification purposes.

35mm photographs are taken of representative sample points to document substrate, bark debris, algal and animal life and any other debris/objects that may be of concern. Water depth measurements are taken from a SeaQuest dive computer with an accuracy of +/- 1%. A Suunto

compass will be used for the transect compass headings, attached to a three foot measuring rule.

The field data was analyzed to meet the criteria of the survey intent. The reports are written and the transect data is organized in Geoworks software. Without the extensive data necessary to calculate bark debris coverage area to a reasonable confidence level, areal extent was calculated with the outermost two transects as the boundaries of bark coverage. Survey surface area calculation was made by taking the triangle formed by neighboring transects and using the transect with the most sample points (longest distance) as the base leg of a right triangle area calculation for that segment of the area. The total square footage of the debris field area was a summation these four triangle areas. This figure was converted to acres as required by the guidelines.

To determine areal extent of substrate with 100 % cover by bark debris, the percentage of sample points with 100 % coverage was calculated and multiplied by the total sample area to derive the areal extent in acres. The same procedure was used to determine areal extent for the area with 100 % coverage and debris depth of ten centimeters or greater and 100 % coverage.

Results:

Site: Tolstoi Bay 1	
Date Surveyed: 5/2/96	Total # of Sample Points: 71
Time of Sampling: 1032	Average Bark Depth: 15.1 cm
Sampler: C. Sempert	Calculated Survey Area: 1.7 acre

Area with some Debris Cover	Area with 100% cover	Area w/ 100%Cover and Debris Depth >10 cm
1.7 acre	0.9 acre	0.7 acre

The re-established permanent reference point is in the center of the drive down ramp and located at a depth of approximately +7 feet MLLW. A total of 71 sample points were taken on the five transects. Of these, 31 (44%) had a measured debris depth of ten centimeters or greater and an estimated 100% coverage. 37 sample points (52%) had 100% bark debris cover. Sample points with the greatest bark depth are in the immediate vicinity of the input point at the base of the ramp's fill rock slope along transects 290, 320 and 350. The surface area covered by a continuous layer of bark debris extends out to the cutoff depth limitation where sampling is stopped, except on the rocky reefs of transects 020 and 050, and was calculated to be

approximately 1.7 acres.

Observations:

Weather conditions at survey time were mostly cloudy with occasional light rainshowers ending by survey time, winds northwesterly at ten knots, air temperature in the mid forties. The diving started at 0950 and took place during the last half of a flood tide. A low slack tide occurred at 0552 of -1.2 feet (corrected to subordinate station #1461, Hadley, and based on the Ketchikan tables) and the closest high tide was at 1215 at 15.5 feet. A tidal exchange of 16.7 feet produced light west to east current, the dominant flow pattern as noted in previous surveys. Water temperature was measured to be 48 degrees, visibility was estimated at 2-3 feet in the first ten feet of water and increasing to 8-12 feet with depth.

On the steep rock slopes of the ramp the bark debris was composed of small bark debris particles with scattered large chunks (>10.2 cm) and chips (between 1.3 cm and 10.2 cm) with occasional branches. The gaps and crevices between the boulders of the ramp slope have been pretty much filled in by debris with some rocks protruding through the debris. Beyond the base of the fill rock on the natural bottom, the first several sample points past had a uniform layer of fine, deep bark dust (<1.3 cm in particle size) with occasional fresh branches and some bark chunks mixed in. A light sprinkling of fresh appearing sawdust was present enough to be noticeable.

The location of the LTF near the mouth of a small bay well up into the larger Tolstoi bay and the prominent reefs extending out from shore in the vicinity of transects 020 and 050 are some of the factors that create a dominant east to west current pattern during most tide conditions. This prevailing current causes a debris deposition plume in a westerly direction.

Other than the accumulation of bark debris itself, no visible signs of an unhealthy ecosystem were observed. Waste products excreted by wood eating organisms appear to be accumulating rapidly around large chunks of wood and sunken logs indicating an active wood boring community. There was no sign of the debris acting as a barrier to oxygen exchange leading to anaerobic conditions; no gas bubble evolution was observed and no black, anaerobic layers were found when random sample trenches were dug by hand in the debris layer.

Some marine life was observed throughout the entire sample area. The gravel/rocky ramp surface had substantial filamentous algae and kelp growth. Even on the steep ramp slopes where the bark debris accumulation is unstable, a few organisms like Sea stars, Green sea urchins, Sea cucumbers and a Kelp greenling were observed. In areas of uniform, thick bark debris the predominant species were Sea cucumbers and hermit crabs with a light, patchy bacterial layer on the surface of the debris. Where rocky substrate was available, mostly on the reef crossing

transects 020 and 050, kelp and typical encrusting organisms were present.

Where the bark layer was thin enough, out towards the end of the transects, benthic organisms such as tube anemones and some evidence of clams were observed. One Sun star was observed actively digging down through the debris into the substrate after the clam prey.

No significant manmade debris was observed. Banding wire was the only debris noticed during the dives.

If there are any questions about the survey or this report, please call us at 907-826-3481. Thank you for allowing Craig's Dive Center to be of service.

Report by:

Craig Sempert

Table 1

Transect Location

Transects	Reference Point Location
290 320 350 020 050	Centered in the middle of the drive down ramp at a depth estimated to be close to zero feet MLLW (actual = +7 ft MLLW), still on the main road bed.

Table 2

Transect Data

Transect-Sample Pt.	Depth from MLLW	Debris Depth (cm)	Percent Coverage
Ref. Pt.	+7	<3	<10
290/1	+1	<3	<10
290/2	10	31	90
290/3	12	53	100
290/4	18	46	100
290/5	21	53	100
290/6	25	23	100
290/7	30	33	100
290/8	32	18	100
290/9	35	15	100
290/10	39	13	100
290/11	43	5	90
290/12	48	5	90
290/13	52	3	90
320/1	0	3	<10
320/2	4	5	90
320/3	16	25	100

Table 2 (cont.)

Transect-Sample Pt.	Depth from MLLW	Debris Depth (cm)	Percent Coverage
320/4	29	43	100
320/5	35	51	100
320/6	40	15	100
320/7	46	15	100
320/8	51	10	100
320/9	55	8	100
320/10	60	5	100
350/1	+2	<3	<10
350/2	3	<3	50
350/3	11	20	100
350/4	20	25	100
350/5	23	36	100
350/6	26	23	100
350/7	30	20	100
350/8	34	23	100
350/9	39	25	100
350/10	46	8	100
350/11	52	8	90
350/12	57	5	90
020/1	+3	3	50
020/2	+2	3	50
020/3	4	10	50
020/4	8	33	100
020/5	10	43	100
020/6	10	10	75
020/7	8	10	75
020/8	10	<3	75
020/9	11	13	75
020/10	16	8	100
020/11	21	8	100
020/12	27	5	95
020/13	38	10	75
020/14	44	3	90
020/15	51	<3	90
020/16	56	3	50

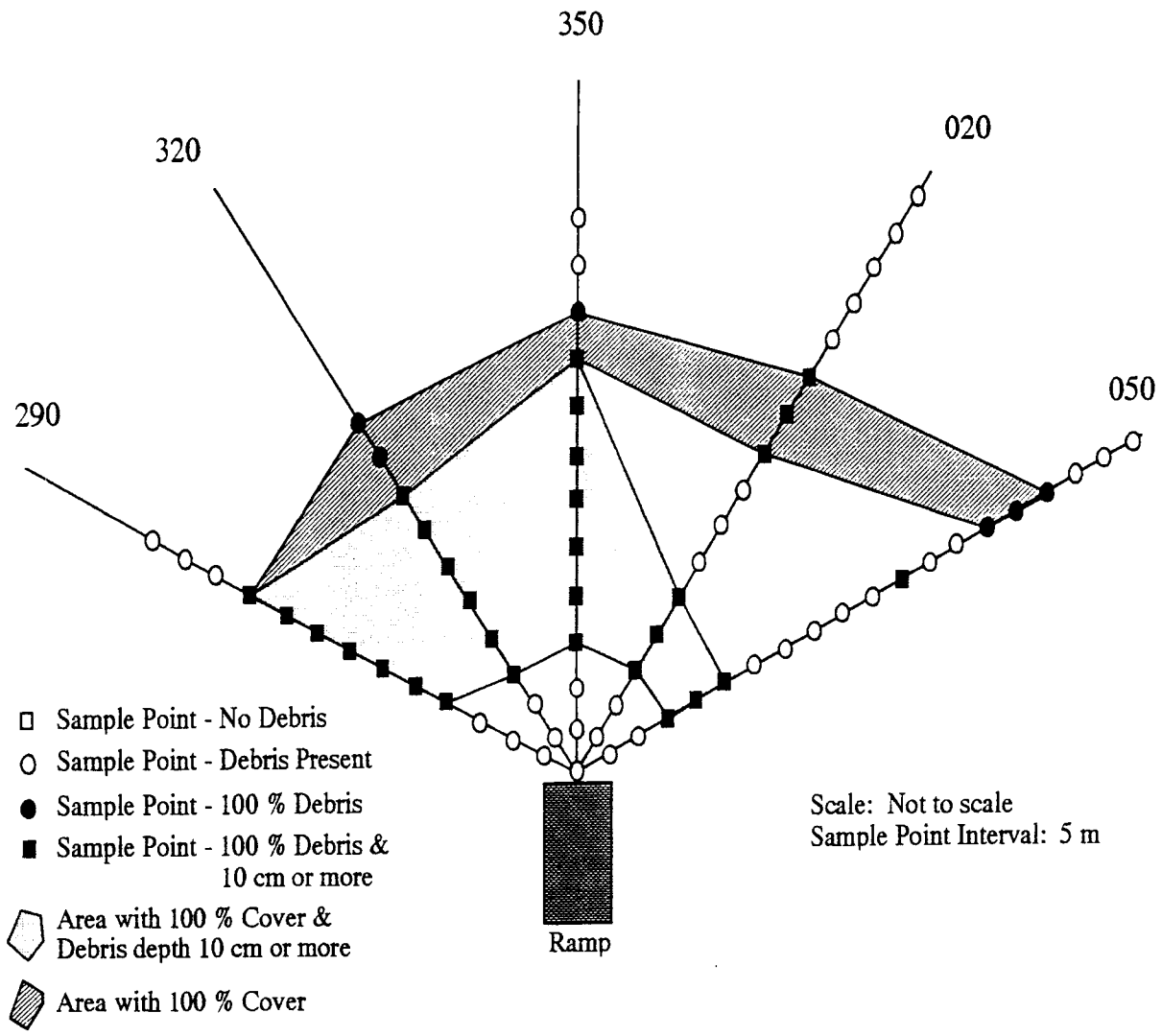
Table 2 (cont.)

Transect-Sample Pt.	Depth from MLLW	Debris Depth (cm)	Percent Coverage
050/1	+2	<3	<10
050/2	0	<3	<10
050/3	4	43	100
050/4	4	56	100
050/5	4	36	100
050/6	+1	<3	<10
050/7	+3	<3	<10
050/8	+2	<3	<10
050/9	3	<3	<10
050/10	12	<3	25
050/11	15	10	100
050/12	15	8	90
050/13	17	5	90
050/14	22	8	100
050/15	27	8	100
050/16	32	5	100
050/17	39	5	90
050/18	45	3	75
050/19	52	3	75

Table 3

Photograph Key

Photo #	Transect/ Sample Pt.	Description
1	Ref. Pt.	Ramp fill rock w/ algae & in bad visibility
2	290/1	Ramp gravel surface w/ filamentous algae
3	290/2	Beginning of steep slope to bottom
4	290/3	Small log on small sized bark debris
5	290/4	100 % debris cover
6	290/5	Sea cucumber, small Sun star on debris
7	290/6	Branch on fine bark debris
8	290/7	Uniform bark debris layer w/ bacteria
9	290/8	Small, old decayed log & kelp piece
10	290/9	Sun star digging down after clam
11	290/10	Sea cucumber on debris surface
12	290/11	Sand/shell substrate now visible
13	350/1	Scattered large bark pieces on ramp
14	350/2	Debris in pockets in the fill rocks
15	350/3	Deep accumulation of debris on ramp toe
16	350/4	Uniform debris w/ some bacterial patches
17	350/5	Fresh sawdust scattered on debris surface
18	350/6	Mixed debris sizes w/ some sawdust



5/2/96 Tolstoi LTF U/W Bark Debris Survey